

CLASSIFICATION CONFIDENTIAL **CONFIDENTIAL**CENTRAL INTELLIGENCE AGENCY
INFORMATION FROM
FOREIGN DOCUMENTS OR RADIO BROADCASTS CD NO.

REPORT

50X1-HUM

COUNTRY USSR

SUBJECT Scientific - Geodesy

DATE OF
INFORMATION 1948HOW
PUBLISHED Book

DATE DIST. 17 MAY 1950

WHERE
PUBLISHED Moscow

NO. OF PAGES 4

DATE
PUBLISHED 1948

LANGUAGE Russian

SUPPLEMENT TO
REPORT NO.

THIS DOCUMENT CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE
OF THE UNITED STATES WITHIN THE MEANING OF ESPIONAGE ACT, 50
U. S. C. 31 AND 32, AS AMENDED. ITS TRANSMISSION OR THE REVELATION
OF ITS CONTENTS IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PRO-
HIBITED BY LAW. REPRODUCTION OF THIS FORM IS PROHIBITED.

THIS IS UNEVALUATED INFORMATION

SOURCE Geodeziya, Izdatel'stvo geodezicheskoy i kartograficheskoy literatury,

50X1-HUM

TABLE OF CONTENTS FOR "GEODESY"
BY PROF A. M. VIROVETS AND ENGINEER M. N. KUTUZOV

This book has been approved by the Administration of Schools of the Main Administration of Cartography and Geodesy as a textbook for technical schools on topography. It is concerned mainly with problems relating to the practical part of higher geodesy, e.g., the construction of geodesic networks, methods of geodesic measurements, and methods of processing these measurements as they occur in geodesic networks of the second and lower orders. Only the basic and most important concepts are given on spheroidal geodesy.

TABLE OF CONTENTS

	<u>Page</u>
Foreword	7
Introduction	
1. Tasks of Higher Geodesy	8
2. Concept of the Figure of the Earth (Geoid)	8
3. Terrestrial Ellipsoid	10
4. Concept of Degree Measurements	12
5. Methods of Solving Practical Problems on Higher Geodesy	16
I. Triangulation	
6. Substance of the Method	20
7. Triangulation Classification in the USSR	21
8. Effect of Observational Errors in Triangulation	29
9. Base Networks	38
II. Base Measurements	
10. Standards Adopted for Line Measurements; Comparators	39
11. Measurements of Bases	43

- 1 -

CONFIDENTIAL

CLASSIFICATION		CONFIDENTIAL		DISTRIBUTION							
STATE	☒ NAVY	☒ NSRB									
ARMY	☒ AIR	☒ FBI									

CONFIDENTIAL

CONFIDENTIAL

50X1-HUM

	<u>Page</u>
III. Preliminary Survey of Triangulation Points and Erection of Marks	
12. Preliminary Survey of Triangulation Points	53
13. Erection of Triangulation Marks	60
14. Laying Out Centers	69
IV. Goniometers	
15. Construction of Geodesic Goniometers	72
16. Checking Universals (Transits)	90
17. Testing Universals (Transits)	99
18. Influence of Instrumental Errors	124
V. Measurement of Angles	
19. Methods of Measuring Horizontal Angles and Directions	129
20. Equalization of Observations at the Station	150
21. Measurement of Zenith Distances	159
22. Definition of Elements of Reduction	167
23. Preliminary Calculations in Triangulation	171
VI. Precise Polygonometry	
24. General Information on Development of Supporting Network by Precise Polygonometry	180
VII. Class II Leveling	
25. General Information	188
26. Methods of Class II Leveling; Levels and Level Rods; Their Checking	192
27. Production of Leveling Work	218
28. Field and Office Leveling Calculations	224
VIII. Surveying Basis for Assembling Photographs	
29. Methods of Developing Surveying Basis	230
IX. Geometry of Terrestrial Ellipsoid	
30. Base Lines and Planes of the Ellipsoid	240
31. Coordinate Systems Used in Geodesy	242
32. Connection between the Geodesic Latitude B and the Coordinates x and y Belonging to the Center and Axes of the Meridional Ellipse	244
33. Main Radii of Curvature at a Given Point of the Ellipsoid	245
34. Use of Radii of Curvature Formulas	248
35. Formulas for Longitudinal and Latitudinal Arcs	249
36. Mutually Perpendicular Cross Sections; Geodesic Line	254
37. Solution of Triangles on the Ellipsoid; Legendre Theorem	256
38. Schreiber's Formulas for Calculation of Geodesic Coordinates and Azimuths	261
39. Inverse Geodesic Problem	270

- 2 -

CONFIDENTIAL

CONFIDENTIAL

CONFIDENTIAL
CONFIDENTIAL

50X1-HUM

	<u>Page</u>
X. Gaussian Coordinates	
40. Basic Ideas on the Gaussian Coordinate System	272
41. Preliminary Notes on Connection between Geodesic Coordinates and Gaussian Coordinates	276
42. Connection between Geodesic and Rectilinear Ellipsoidal Coordinates	276
43. Scale of Reflections	278
44. Concept of Conformal Reflections	281
45. Formulas for Changing from Geodesic Coordinates to Gaussian Coordinates	283
46. Gaussian Approximation of Meridians	285
47. Formulas for the Calculation of Geodesic Coordinates from Known Gaussian Coordinates	286
48. Reflection of Triangulation on a Plane in the Gaussian Projection	286
49. Reduction of Distances in the Gaussian Projection	289
50. Reduction of Directions	291
51. Formula for Changing from the Geodesic Azimuth to Directional Angle	295
52. Transformation of Gaussian Coordinates from One Zone into Another	298
53. Sequence of Using Gaussian Coordinate System in Soviet Geodesic Works	301
XI. Least Squares Method	
54. Collection of Formulas on Theory of Measurement Errors	307
55. Principle of Least Squares	314
56. Indirect Measurements; Determination of Unknowns From Indirect Measurements	315
57. Drawing Up Error Equations For Indirect Equally Likely Measurements	318
58. Normal Equations	319
59. Case of Measurements Which Are Not Equally-Likely	322
60. Reducing Nonlinear Equations to Linear Form	324
61. Mean Square Error of Weighted Units	332
62. Solution of Normal Equations	333
63. Solution of Normal Equations by Gaussian Method	332
64. Checking the Construction of Normal Equations	335
65. Solution of Normal Equations by Gauss-Doolittle Method	336
66. Solution of Normal Equations by Method of Consecutive Approximations	340
67. Weights of Equalized Elements	341
68. Weight of a Function of Equalized Elements	346
69. Method of Conditional Measurements	355
70. Average Error of a Measurement with Weight Equal to Unity in Conditional Measurements	359
71. Reduction of Nonlinear Conditional Equations to Linear Form	360
72. Checking Solution of Normal Correlation Equations	362
73. Weight of a Function of Equalized Elements	364
XII. Equalization of Triangulation By Method of Conditional Measurements	
74. General Considerations	371
75. Forms of Conditional Equations	372
76. Number of Conditional Equations in Free Networks	379

- 3 -

CONFIDENTIAL

CONFIDENTIAL

CONFIDENTIAL

50X1-HUM

	<u>Page</u>
77. Conditional Equations for Restricted Networks	391
78. Number of Conditional Equations in Restricted Networks	398
79. Permissible Sizes of Free Members in Conditional Equations of Triangulation Network	398
80. Two-Group Method for Equalization of Triangulation	400
81. Use of Two-Group Method for Equalization of Angles	400
82. Equalization of Class III Triangulation	412
83. Equalization of Class IV Points	413
84. Equalization of Base Series of Class II Triangulation	415
85. Equalization of a System of Base Series of Class II Triangulation	417
 XIII. Equalization of Triangulation Network By Method of Indirect Measurements	
86. General Considerations	423
87. Error Equations	425
88. Four Cases of Construction Error Equations	428
89. Transfer to Normal Equations	428
90. Construction of Reduced Normal Equations and Their Solution	429
91. Direct Multiple Intersection	446
92. Multiple Resection	452
 XIV. Calculation of Preliminary Coordinates	
93. General Considerations	454
94. Simplified Equalization of a Geodesic Quadrangle	454
95. Aner's Simplified Method	458

- E N D -

- 4 -

CONFIDENTIAL